CHAPTER 18

OTHER WAYS OF TRANSPORTING PETROLEUM

Section I. External Loads

SLING-LOADING OPERATIONS

Petroleum may be transported in 500-gallon collapsible fabric drums using the sling loading method. This method enables obstacles to be overcome that hinder other modes of transportation. One or two drums can be sling loaded with a sling set of at least 10,000-pound capacity. Sling nets can be used to transport refueling system components. Refer to FM 55-450-4 for rigging instructions. For more detailed information on external load procedures, see FM 57-38.

LANDING POINTS

All sling-loading operations use 80- to 100-meter diameter landing points. Conditions of the area, such as dusty surfaces or obstacles, may require increased spacing between loads, reducing the number of helicopters that can operate at the site at one time, and decreasing the overall speed of the operation. When selecting a site, you should make sure the site is cleared of any loose materials or debris to prevent it from being blown into the ground crew or rotor blades, or drawn into the helicopter engines. The landing site should provide maximum security and concealment. Landing points used for supply or resupply should be located near supply points to reduce ground movement of cargo after delivery.

UNIT RESPONSIBILITIES

Most sling-load operations involve three elements: the supported unit whose equipment will be moved, the supporting unit that will fly the loads, and the pathfinder element. Each element's responsibilities are discussed below.

- Supported Unit. The supported unit must coordinate in advance with the supporting unit. The supported unit will provide slings, straps, clevises, and any other equipment required for the move. They will perform the actual rigging of the aircraft. Ideally, the supported unit will provide the hook-up team. They will also ensure that the loads are properly rigged and do not exceed the allowable cargo load of the aircraft.
- Supporting Unit. The supporting unit provides advice and technical assistance to the supported unit as needed. The unit will ensure that the load does not exceed the allowable cargo load of the aircraft transporting the load.
- Pathfinder Element. The pathfinder element provides advice and assistance to both the supported and supporting units. The pathfinder will supervise the rigging and inspection of all loads. It will also ensure that the load does not exceed the authorized load capacity of the aircraft. It will also provide ground guidance and air traffic control during the sling load.

EQUIPMENT

The essential equipment used in external load operations are cargo nets and slings. The components are described below. Inspection, care, and storage of sling sets and nets are described in FM 55-450-1.

Sling Sets

Sling sets are used to externally transport 500-gallon collapsible drums. The primary sling sets used are the 10,000- and- 25,000-pound capacity. Both sling sets are similar except for a few minor differences. All parts are clearly marked. Do not mix up the sets. A sling with only one lifting leg is shown in Figure 18-1, page 18-2. Obvious differences between the two sling sets are shown in Table 18-1.

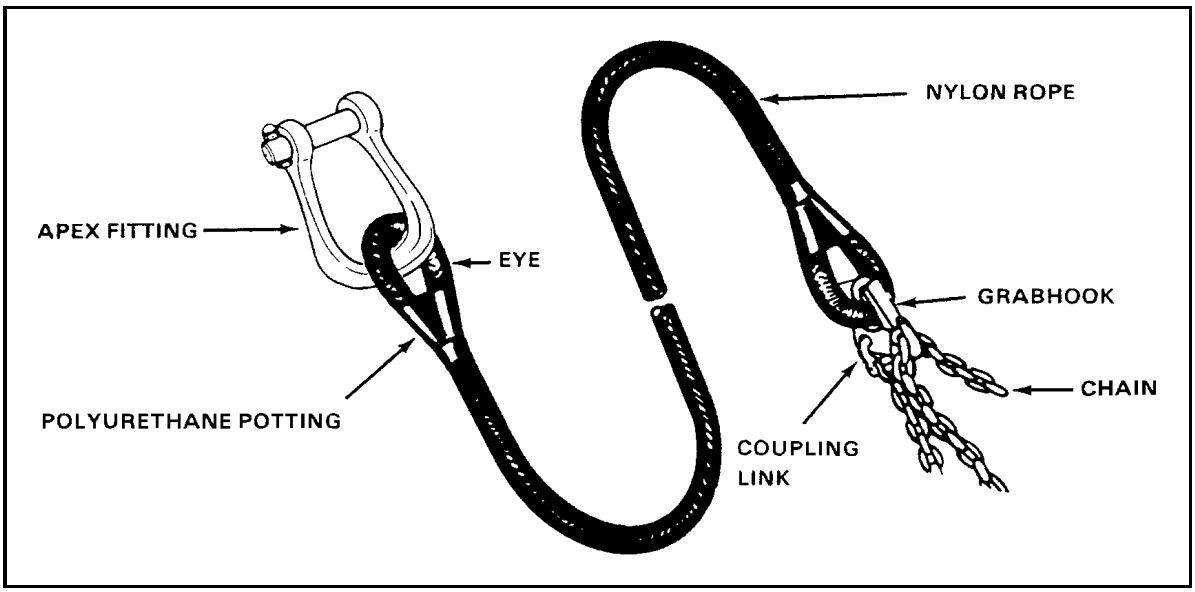

Figure 18-1. The 10,000-pound capacity sling set components

Table 18-1. Visible differences between the 10,000- and 25,000-pound capacity sling set

ITEM	10,000-POUND CAPACITY	25,000-POUND CAPACITY
SLING ROPE COLOR	OLIVE DRAB	BLACK
SLING ROPE DIAMETER	7/8-INCH	1 ¼-INCH
CLEVIS COLOR	DULL GRAY ALUMINUM	GOLD STEEL
NUMBER CHAIN LINKS	111 (APPROXIMATE)	88
WEIGHT	52 POUNDS	114 POUNDS

•Nylon rope assembly. The nylon rope assembly is made from double-braided nylon rope with an eye splice at each end. The assembly is 12 feet long. However, the manufacturing process and shipment can result in shrinkage. The shrinkage is normally temporary and is usually restored with use. To ensure proper load distribution, the variation in lengths should not exceed 6 inches. The part number, NSN, and the capacity of the individual legs are embossed on the eye splice. The 2,500-pound nylon rope assembly is 7/8-inch in diameter. It is used with the 10,000-pound sling set. The 6,250 pound nylon rope assembly is 1 1/4-inch in diameter. It is used with the 25,000-pound sling set.

NOTE: Each of the four legs will carry only one fourth of the total weight capacity of the sling sets.

•Apex fitting. The metal apex fitting attaches directly to the helicopter hook, except on the UH-1. A nylon donut must be used between the sling and the aircraft hook because of the shear pin design of the UH-1 hook. Each apex fitting consists of a clevis, pin, safety bolt, and locknut. The clevises for both capacity sling sets are the same size but are made of different metals and have different pin sizes. The 10,000-pound capacity clevis is dull gray colored aluminum and uses a 1 1/8-inch diameter pin. The 25,000-pound capacity clevis is made of gold color alloy steel and uses a 1 1/2-inch pin.

•Grab hook assembly. The grab hook assembly is attached to the lower eye of the nylon rope. It is used to attach the nylon rope assembly to the chain. It is also used to adjust the length of the chain. The chain is kept on the grab hook by a spring-loaded keeper. The same type of grab hooks are used for both the 10,000- and 25,000-pound capacity slings. However, they are not interchangeable. The 10,000-pound capacity is smaller. The part number and capacity are embossed on the grab hook.

•Chains. The chains for both size slings are welded steel alloy. The normal length of the chain is 8 feet, allowing for adjustments from 0 to 4 feet. The chain is used as a loop. The 10,000-pound capacity set has about 111 links and the 25,000-pound set has 88 links. The links in the 25,000-pound set are larger than the 10,000-pound set. Every tenth link on both sets is painted olive drab. The chain is attached to the grab hook so that the free end will contain 10 links to the first painted link. When rigging a load, start counting the links from the free end.

Cargo Nets

There are two sizes of cargo nets. These are 5,000- and 10,000-pound capacity cargo nets. These nets are used to externally transport general cargo. Maintenance, inspection and rigging instructions are described in FM 55-450-3. The 5,000- and 10,000-pound nets are both used in the same manner. They are described below.

•The 5,000-pound capacity net. The 5,000-pound capacity net as shown in Figure 18-2 has a cubic capacity of 125 cubic feet. The net is octagon shaped and measures 15 feet across the flat sides. The net is olive drab in color and is made of nylon cord with webbing lifting loops. Each set of four lifting loops has a metal hook located at the top center to provide an attachment point to hook the lifting legs to the apex fitting. The apex fitting is a metal, oval-shaped device attached to one of the four suspension straps. The four hooks are hooked to the apex. The apex fitting is then attached to the helicopter cargo hook.

•The 10,000-pound capacity net. The 10,000-pound capacity net as shown in Figure 18-3 is also made of nylon mesh cord with webbing lifting loops. The net has a maximum cubic capacity of 380 cubic feet, weighs 96 pounds, and comes in a canvas cover. The net is black nylon, octagon shaped, and measures 18 feet across the flat sides. A yellow cord outlines the load area in the center of the net. There are four sets of lifting legs made from 1 3/4-inch wide nylon webbing attached to the outside of the net. Each leg is 11 feet in length with a hook to attach to the apex.

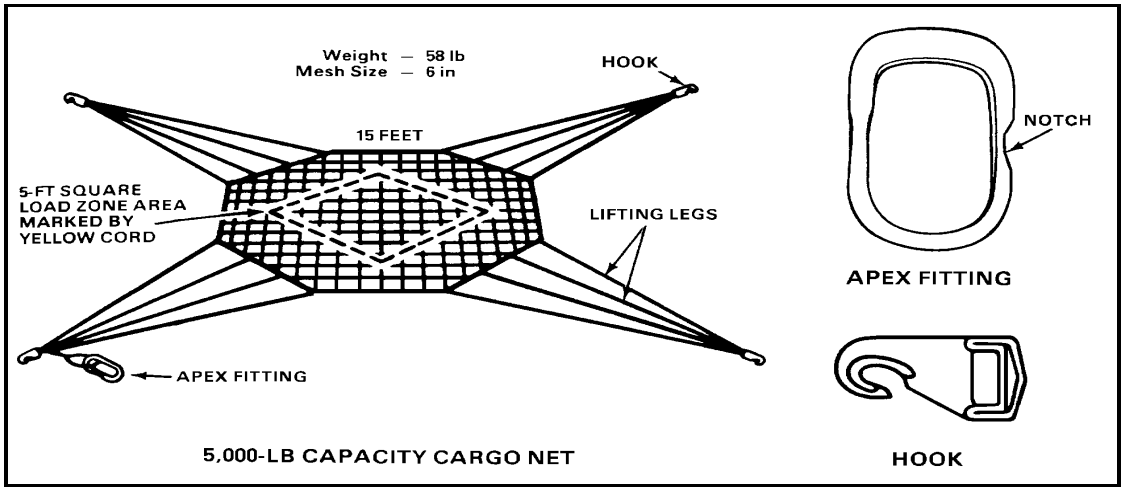

Figure 18-2. The 5,000-pound capacity cargo net

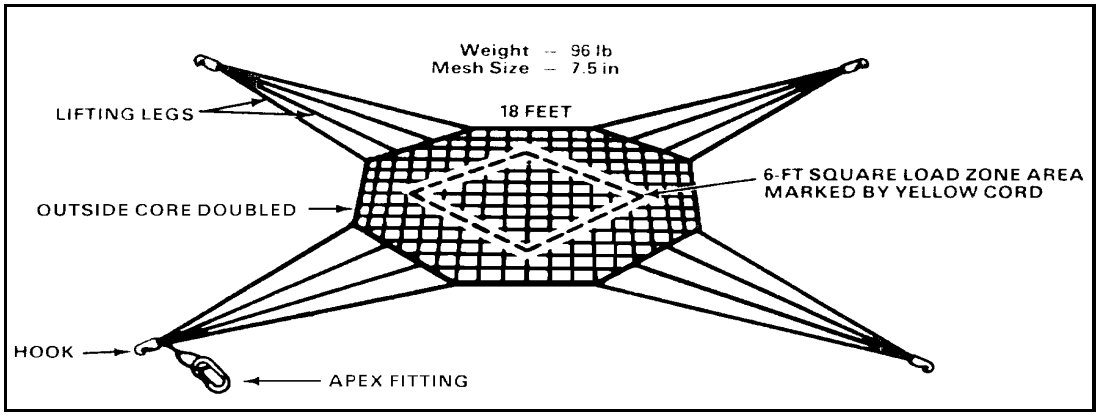

Figure 18-3. The 10,000-pound cargo net

HOOKUP AND RELEASE PROCEDURES

Hookup of a load requires a team effort. The hook-up team requires a minimum of three personnel: the signalman, the hook-up man, and his assistant. The signalman must position the aircraft over the load so that the hook-up man and his assistant can discharge the static electricity and attach the load to the aircraft as quickly and safely as possible. Release of the load is usually done by the air crew and only requires a signalman from the ground crew.

Ground Crew Protective Measures and Equipment

Ground crews working around hovering aircraft are exposed to a variety of hazards. To protect the crews the following equipment is recommended or required. See Figure 18-4, page 18-5.

•Helmet. The helmet provides protection against head injuries from flying debris and from being caught between the aircraft and the load. Helmets must be securely fastened.

•Eye protection. Goggles must be worn as a minimum to protect the eyes from airborne dust and debris caused by rotor wash. A helmet with shield can also be used. A protective mask provides the best protection; however, it can cause a problem with depth perception and is not recommended for signalmen.

•Hearing protection. Prolonged exposure to high intensity noise experienced in sling load operations can cause hearing damage. Earplugs or earmuffs must be worn.

•Hand protection. Leather gloves should be worn to protect the hands and fingers. If electrical gloves are available, they should be worn by the person manning the static wand for added protection from static discharge burns.

•Static discharge wand. In flight a helicopter generates and stores a charge of static electricity. When the helicopter lands, this charge is grounded out. While the helicopter is in flight, however, this charge remains stored unless a path is provided for it to be channeled into the earth. A ground crewman provides this path by contacting the helicopter cargo hook with the apex fitting when the aircraft is hovering over the cargo hook-up point. Although this charge may not cause an electrical burn, it can cause a muscular reaction which may, if the individual concerned is on an unsure footing, result in injury from a fall. An individual shocked by the electricity may also suffer a delayed discomfort from muscular cramps or spasms.

••To avoid the possibility of a static electric shock, ground crewmen use static discharge wands (field expedient or manufactured) and grounding stakes to ground the cargo hook. Since the wand channels the electricity from the helicopter directly into the ground, the ground crewman will not be shocked when he connects the apex fitting to the cargo hook as shown in See Figure 18-5, page 18-6.

••Inspect the static discharge wand for serviceability. Select the grounding stake location, it should be on the opposite side of the ground crew's exit direction so that they will not trip over it as they depart. When operating on hard surfaces, position the load near the edge of the surface so the grounding stake can be driven into the ground.

••Drive the stake into the ground until it is firmly seated--at least 6 to 8 inches in firm ground and 24 inches in sandy or loose soil. Drive the stake in at a 45-degree angle away from the side of the load in case someone falls on it. Connect the cable clamp to the vertical shaft of the stake.

••Even though the helicopter has been grounded, the ground crew should not touch the cargo hook. Since the helicopter can recharge in less than 1 second, the wand operator must maintain continuous grounding contact. If contact is lost, all personnel must pull back from the cargo hook until contact is reestablished.

•Other equipment. Smoke grenades are used to mark the location of the landing point or to show wind direction. Flashlights with wands are used to give hand and arm signals during night operations.

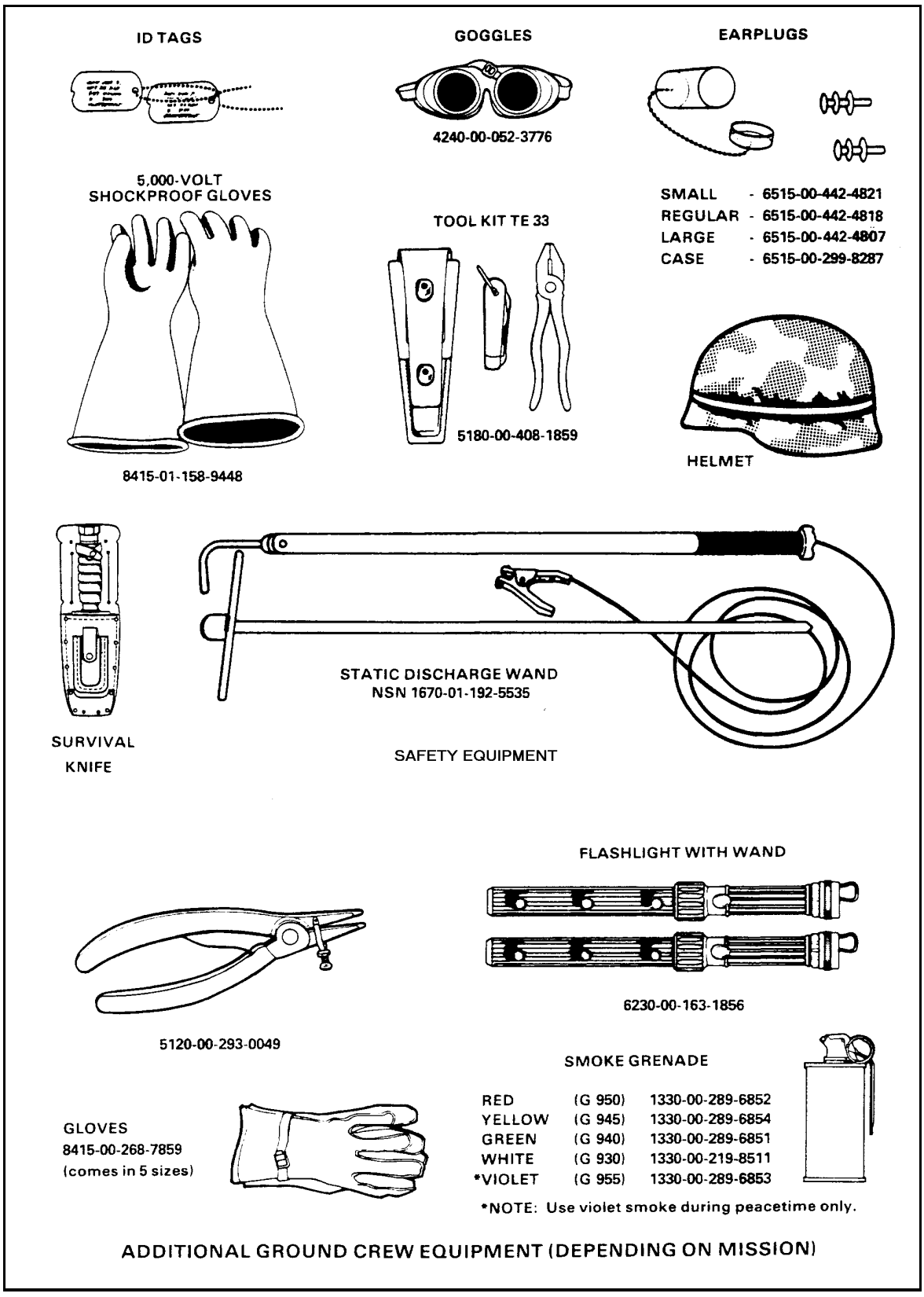

Figure 18-4. Ground crew safety equipment

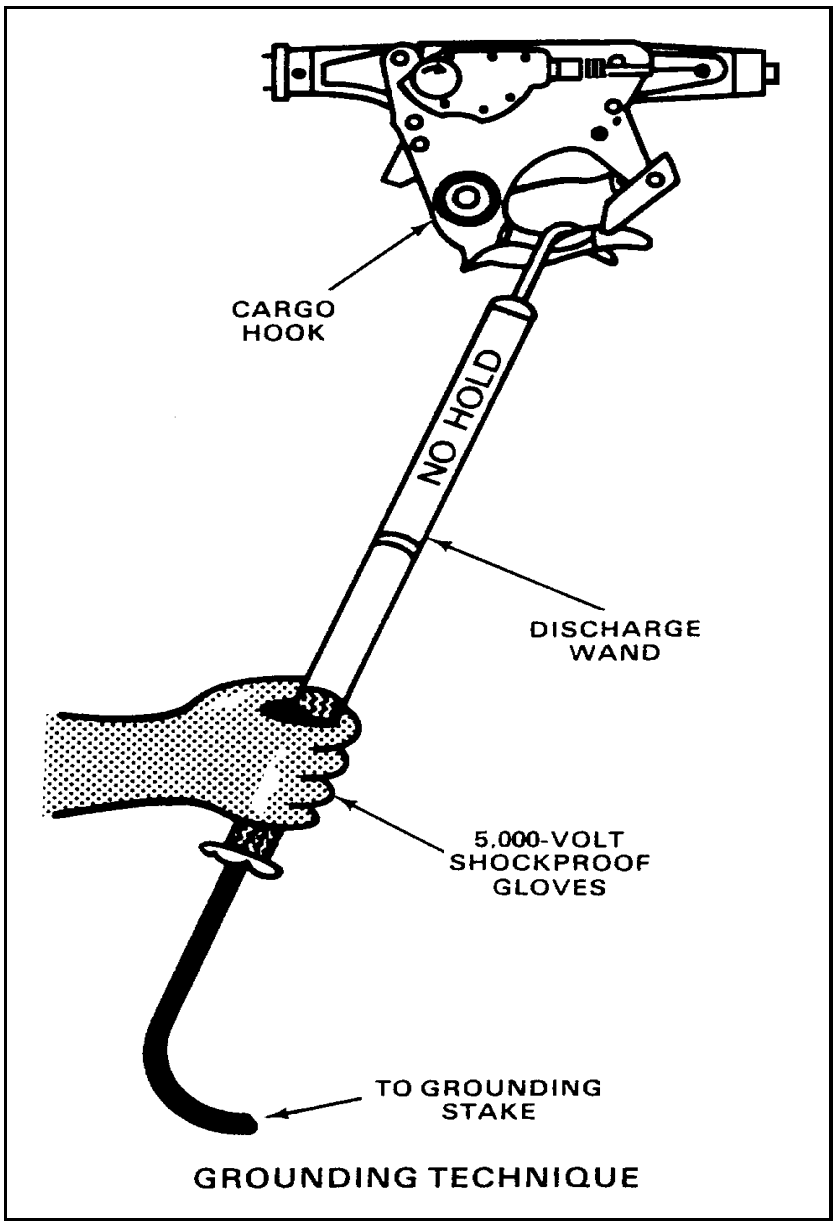

Figure 18-5. Grounding technique

Safety Measures

In addition to using the proper equipment, the following safety measures must also be followed:

- Wear long-sleeved shirts with the sleeves rolled down and fastened. Button the shirt collar.
- Police the sling-load area thoroughly before conducting operations to reduce the amount of debris that can be thrown around by rotor wash.
- Remain alert during hookup and release operations. Be ready at all times to get clear of the load. Soldiers have been crushed between the aircraft and loads, have had loads dragged over them, or have taken an unwanted ride because they have inadvertently become entangled with the load. Use extra caution if the load must be mounted to affect hookup. Slings under tension can crush a limb against the load.

Ground Crew Duties

The ground crew will normally have one signalman and two hook-up men.

•Duties of the signalman.

••Before the arrival of the aircraft, the signalman directs the positioning of the load. He inspects the load for proper rigging and that it is ready to fly.

••As the helicopter approaches, the signalman positions himself 20 meters in front of the load maintaining eye contact with the crew and gives the hand and arm signal "assume guidance." As the helicopter reaches the load, he gives hand and arm signals to position the aircraft directly over the load and close enough for the hook-up men to place the apex fitting on the cargo hook. It is critical that the signalman positions himself where the pilot is able to see him.

••During the hookup, the signalman must observe the apex fitting and cargo hook. Once hookup has been done, he must hold the aircraft at a hover until the hook-up men are clear of the area. When they are clear, the signalman signals the aircraft upward slowly so that the sling legs gradually take up the load. This is to ensure that the sling legs are not fouled. If they are fouled, the signalman motions the pilot downward and then instructs him to cut away the load. If the load has been successfully suspended, the signalman will give the signal to depart and move quickly out of the way.

WARNING
At no time will the signalman allow a suspended load to pass over the head of any ground crew member.

•Duties of the hook-up men.

••One man handles the static discharge wand and the cargo hook while the other controls the apex fitting of the sling load. Hookup must be done quickly yet safely to reduce helicopter hover time and minimize exposure time of the hook-up men under the helicopter.

••The hook-up men will be in position of the load when the helicopter arrives. As the helicopter hovers over the load, the hook-up men position themselves to perform the hookup quickly and not obscure the signalman's observation of the operation.

••When the helicopter is in correct position for hook-up, the static ground man grounds the aircraft by contacting the static wand to the cargo hook as shown in Figure 18-5, page 18-6, and maintains continuous grounding contact. The hook-up man then places the apex fitting on the cargo hook and ensures that the hook is properly closed.

••After the load is properly hooked to the aircraft, the hook-up team moves quickly aside to the predesignated rendezvous area. If any of the legs become fouled and it is necessary to rehook the load, the signalman notifies the pilot.

Release Procedures

For release operations, the hook-up team is referred to as the cargo release team. As the helicopter approaches the site, it takes instructions from the signalman, who will guide them to the cargo release point. The cargo release team stands by unless they are needed to manually release the load. The signalman directs the helicopter to set the load on the ground and then gives the release signal. At this time, the apex fitting should fall free of the cargo hook. If it does not, the signalman signals the aircraft to hover and then directs the cargo release team to move under the helicopter to manually release the load from the hook. When the load is free of the hook and the release team is no longer under the aircraft, the signalman directs the aircraft to depart and quickly moves out of the way. If the cargo release hook cannot be opened by activating it from within the helicopter or by the cargo release team, emergency release procedures will be required. The doughnut will have to be disassembled and the aerial delivery slings passed through the hook. If an apex fitting or clevis is used at the attachment point, unscrew the nut and remove the pin. In extreme cases, it may be necessary to derig the load and have the helicopter set down to resolve the situation.

Section II. Aerial Bulk Fuel Delivery System

DESCRIPTION

The ABFDS, shown in Figure 18-6, is designed to be installed as part of the C-130, C-141, or C-5A aircraft. The most commonly used aircraft are the C-130 and C-141. The system uses aerial pillow tanks mounted on a modular platform (2 on a C-130, 3 on a C-141, or 10 on a C-5A) to convert the aircraft quickly and safely into an aerial tanker with a 6,000-gallon capacity for C-130, 9,000-gallon capacity for a C-141, and 30,000-gallon capacity for a C-5A. It has an off-load capacity of 1,200 GPM. Fuel can be off-loaded into trucks, bladders, other containers, and in extreme emergencies, other aircraft. The ABFDS consists of 3,000-gallon pillow tanks, a pallet and tie-down system, two pumping assemblies, two bidirectional flow meters, suction and delivery hoses (additional hose is needed for C-141 installation), and auxiliary equipment and parts. When the system is equipped with a filter/separator it becomes the ADDS. An outside pumping source may be used to fill the tanks. The systems manifold permits both tanks to be emptied with only one pumping module. Air Force personnel are responsible for installing and operating the system, but Army petroleum personnel take part in the off-loading operation.

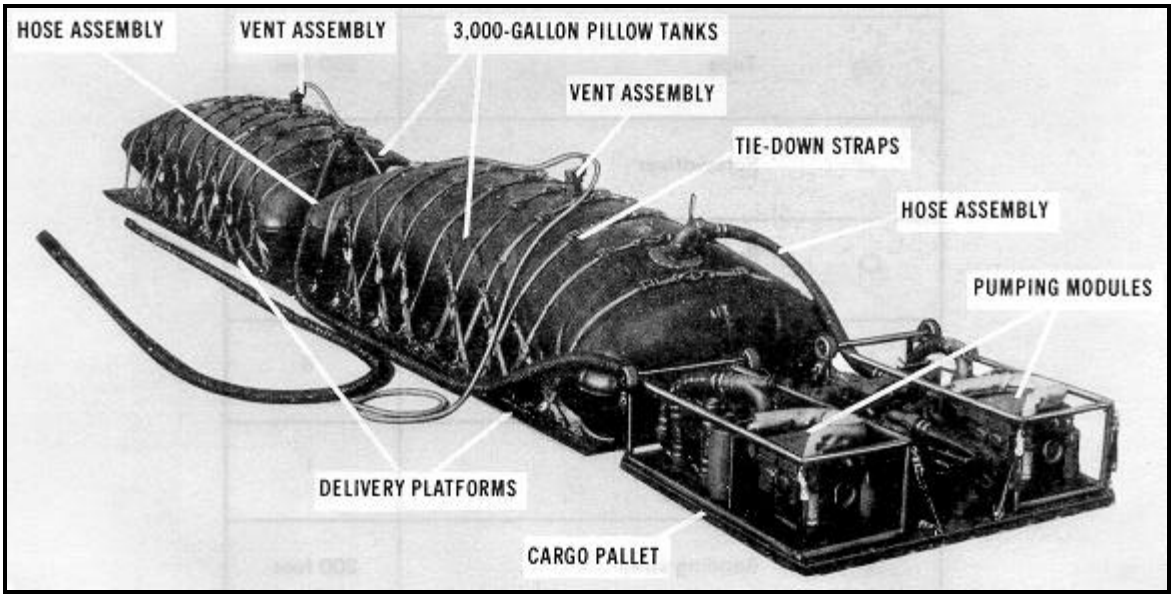

Figure 18-6. Aerial bulk fuel delivery system

Aerial Pillow Tanks

The 3,000-gallon-capacity, rubber-coated pillow tanks are made with internal baffling. This baffling weakens the forces created by the forward and backward surge of the fuel so that it will not affect the flight of fixed-wing aircraft. *A* special harness surrounds the tank to prevent forward movement of the tank during landing under crash conditions. Each tank has an automatic, vapor-elimination valve which is connected by hoses to an overboard vent port. This valve keeps vapors from collecting. Fuel is received and discharged through an elbow fitting mounted on each tank.

Pallet and Tie-Down System

Each 3,000-gallon pillow tank is mounted on a 240-inch-long, 108-inch-wide aerial delivery platform. The tanks are held on the platforms by a series of tie-down straps strong enough to withstand the force of a crash. The platforms fit on the aircraft conveyor system and are securely locked to the aircraft floor. The two pumping modules are mounted on a cargo pallet that is 108 inches long and 88 inches wide and held by straps. The pallet is locked to the aircraft ramp.

Tank Armor System

The tank armor system is an optional item of equipment. It is a blanket in the form of a "sandwich" of plastic reinforced with glass. The blanket wraps around the lower two-thirds of each pillow tank. The system has a glass-reinforced floor liner which protects the tank if the platform splinters from ballistics entering through the aircraft floor. The tank armor system does not protect the pillow tanks from ballistics, but it does cut down on tearing and helps control leaking.

Pumping Modules

One 600-GPM pumping module is connected to each pillow tank. A valved crossover lets one pump fill or discharge from both tanks. The two centrifugal pumps (one per module) are run by four-cylinder, 20-horsepower, gasoline-driven engines (Model 4A084-II). When a C-5A is used, it is equipped with four pumping modules**.** A detailed description of the pumps is in TM 5-2805-213-14. Figure 18-7 shows the pumping modules. A vented, pressurized tank mounted in the module contains fuel for the engine. A 24-volt battery starts the engine. Each engine has a flexible exhaust pipe long enough to reach overboard when the aircraft ramp is down and the engines are running. Each pump has a manually operated drain valve located on the lower part of the pump housing. A drain hose, long enough to reach beyond the aircraft ramp, is attached to this valve when the pump must be drained.

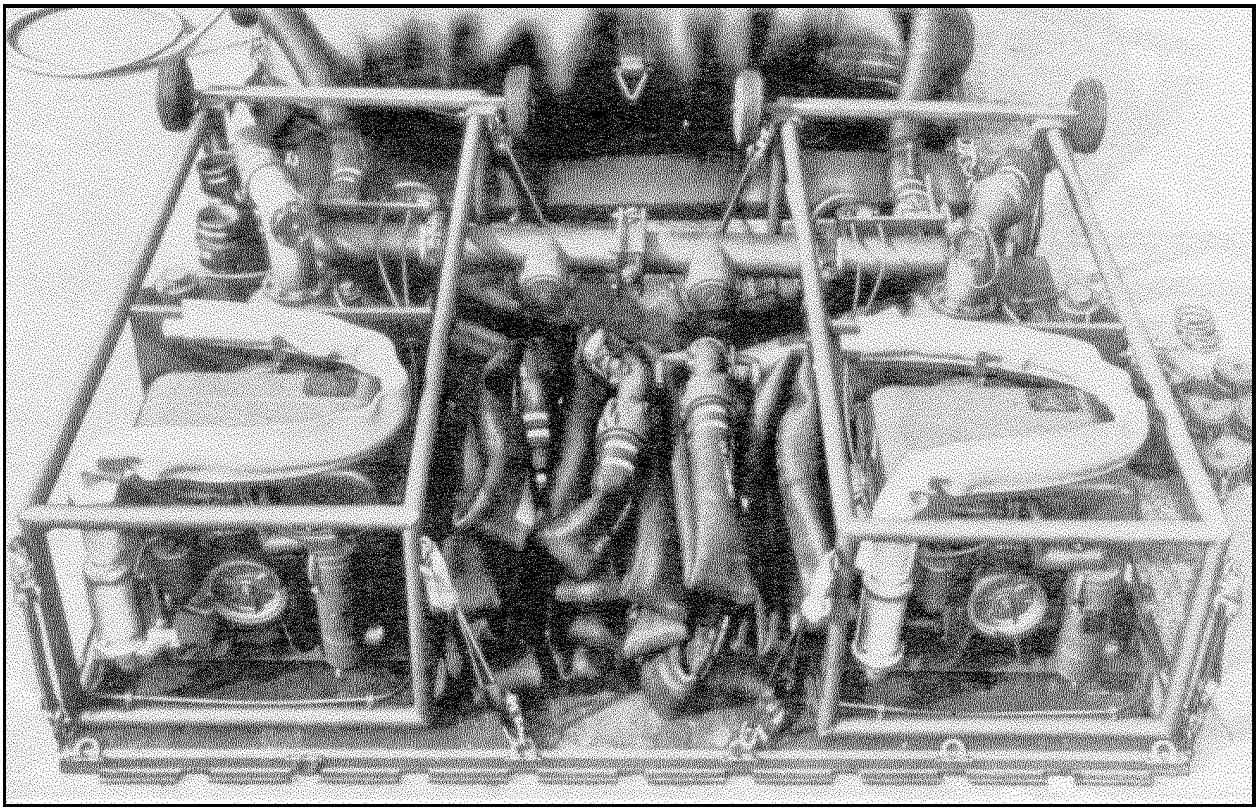

Figure 18-7. Pumping modules

Bidirectional Flow Meters

The two turbine, bidirectional flow meters give readings on the flow of product through the 4-inch line in which they are installed. Each meter is encased in a tubular frame and has a 4-inch, cam-locking male coupling at one end and a female cam-locking coupling at the other end. The meters are usually installed between the pump outlet and manifold inlets, but they may be installed along any point in the 4-inch line to monitor the product flow

in either direction. The reading indicator is an odometer which shows the total in digits on two numerical dial counters. Both counters may be reset to zero.

Suction and Discharge Hoses

The AEBDS has enough suction and discharge hose to install it on the C-130 aircraft. More lengths of hose are required when it is used on the C-141 aircraft. All hoses are 4 inches in diameter. They have cam-locking couplings, one male and one female, at either end. The following are the hoses in the system:

- A 28-foot suction hose to connect the forward tank to the pump module manifold.
- An 8-foot suction hose to connect the rear tank to the pump module manifold.
- Two 4-foot suction hoses, with elbow fittings at the male coupling end, to connect the pump outlet to the meter when the meter is installed at the manifold inlet.
- Two 20-inch suction hoses to replace the meters when they are not installed.
- A 50-foot suction hose to connect the system to an unpressurized, outside fuel supply.
- Four 25-foot delivery hoses to off-load fuel in the tanks. The hoses may be coupled in one 100-foot length or two 50-foot lengths. The system also has two D-1 nozzles for use with the discharge hose.

Auxiliary Equipment and Parts

The frame of the right-hand pumping module has a storage box for the auxiliary equipment and parts. The auxiliary equipment and parts in the system include--

- Two 4-inch, female, back-to-back, cam-locking couplings
- Plugs and caps for sealing the cam-locking couplings during shipment
- Two caps for sealing the Victaulic coupling ends on the manifold
- Two starter ropes for the auxiliary engine
- shims for tightening the cam-locking couplings
- A quick-disconnect plug and hose assembly for draining the engine crankcase

The system also has two devices for detecting volatile fumes.

ALTERNATE CAPABILITY EQUIPMENT

The ABFDS has been modified to include an ACE package by adding a filter/separator with a hose rack and a 35-PSI Center Point Receptacle nozzle. When the ACE package is added to the ABFDS, it becomes the ADDS as shown in See Figure 18-8, page 18-9.

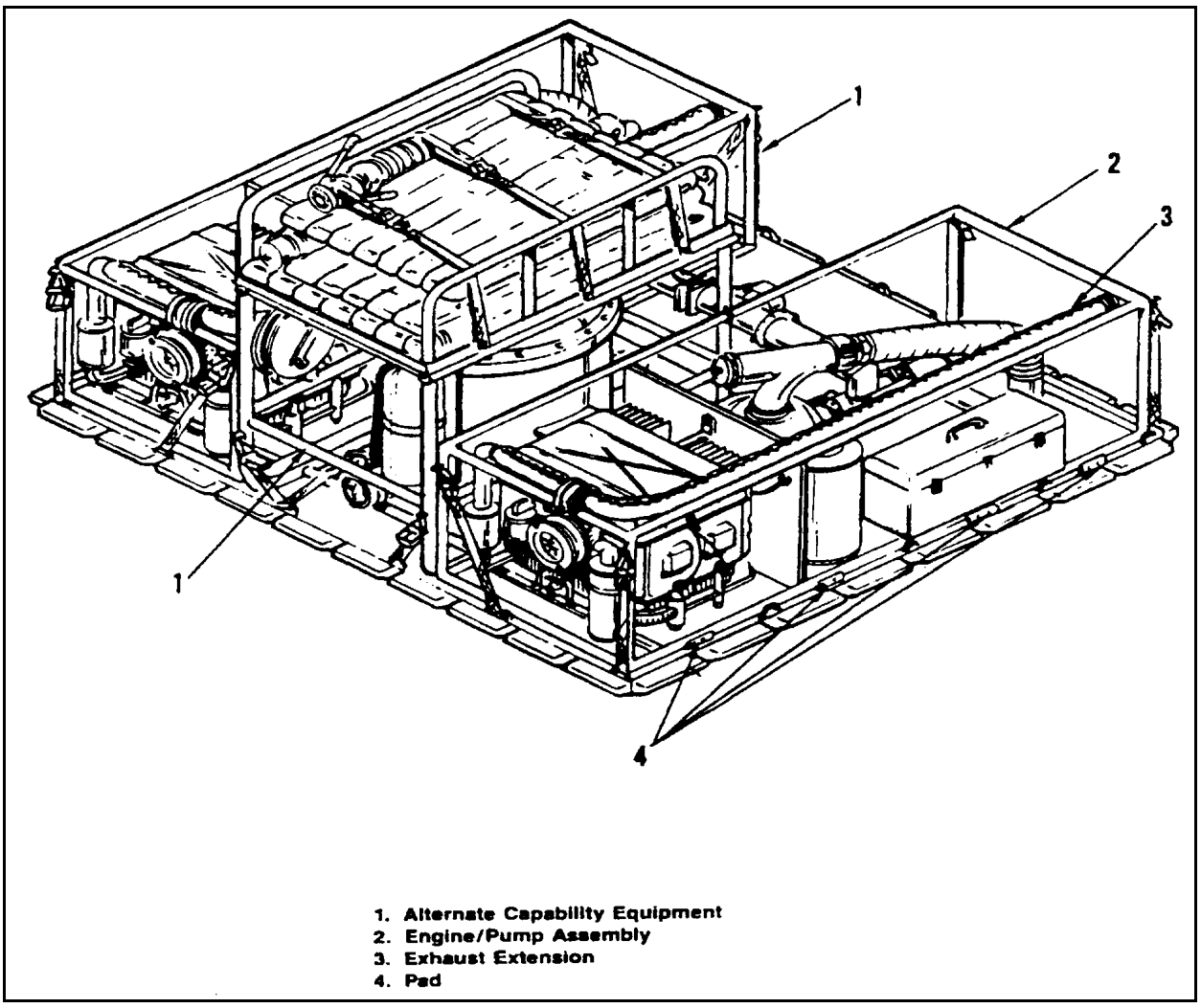

Figure 18-8. Aerial fuel delivery and dispensing system

Components and Functions of the ACE Package

•Filter/separator module. The filter module is designed to fit between the pumping modules. It connects both outlets by means of an interconnecting manifold, thus permitting operation of either pumping module. The filter/separator is rated at 350 GPM and uses a manual vent valve with sufficient hose to allow overboard venting when required. The filter contains 18 elements and 18 canisters. The outlet of the filter is fitted with a dry break adapter to allow disconnecting in the aircraft without the hazard of a fuel spill.

•Hose rack and hoses. A hose rack is mounted on top of the filter/separator frame. The rack is large enough to store the hoses and nozzles required to operate the system. The rack is fitted with three strap assemblies to secure the hoses during transportation. Hoses included in the ACE package are three 2 1/2-inch by 50-foot sections of delivery hose with camlocking couplings on either end.

•Fire extinguishers. Two hand-held, dry chemical, fire extinguishers with mounts are provided. One is mounted for access to the equipment operator and the other is mounted for access by the aircraft servicing personnel.

•Static grounding reel. A manually operated static discharge reel is mounted on the filter/separator frame. The reel contains 165 inches of grounding cable to attach to the equipment being serviced.

•Fuel servicing nozzles. Two types of nozzles are used with the ADDS. The center point receptacle nozzle will mate with the D-1 receptacle on the M969 and M970 fuel semitrailers as well as the M978 HEMTT. The nozzle has a built-in pressure/flow regulator that limits the fuel delivery pressure to 35 PSI. It also includes a

quick disconnect dry-break with an in-line strainer. The nozzle is fitted with a 2 1/2-inch camlocking end to attach to the 2 1/2-inch delivery hose. A CCR nozzle is used for helicopter refueling capability.

USE

The ABFDS, installed in the C-130 aircraft, is used for aerial resupply of bulk petroleum. This resupply takes a variety of forms. The system can be used for the initial movement of bulk petroleum into a theater of operations. It can be used to move bulk petroleum into forward areas. The system is valuable in situations where bulk petroleum is required in an area of operations where tank vehicles cannot go. The system is also capable of quick response; it can move bulk petroleum over long distances over a short period of time. For off-loading, the system can be connected to any item of equipment that can be coupled to a 4-inch line, such as an FSSP, a tank vehicle, or an assault hoseline.

Section III. Wet- Wing Defueling

DESCRIPTION

Wet-wing defueling is transferring fuel from fixed-wing aircraft fuel tanks to collapsible fabric tanks or tank semitrailers. This method of bulk fuel resupply allows the aircraft to carry an internal load of dry cargo plus aviation turbine fuel without requiring additional aircraft to provide fuel support. Wet-wing defueling can supplement other bulk fuel delivery systems. Aircraft used in wet-wing defueling operations include the C-5A, C-130, and C-141 cargo aircraft. Wet-wing defueling from the center point refueling port of these aircraft into Army collapsible fabric tanks or tank semitrailers can be done with an acceptable degree of risk using the correct procedures. Four aircrew members perform the operation.

EQUIPMENT

It is the Army's responsibility to maintain and inspect fuel transfer equipment to ensure that the system is free of leaks in the first 60 feet from the aircraft center point refueling port. Do not use the Army's 350-GPM pump in wet-wing defueling because the excessive suction created could collapse the aircraft fuel manifold; fuel booster pumps on board the aircraft must be used to transfer fuel. The Army will provide the equipment described below to perform wet-wing defueling on Air Force cargo aircraft.

Hose

One 60-foot length of 3-inch collapsible defueling hose is required. The hose must be at least 60 feet in length to make sure no cam-locking couplings are within the 50-foot safety cordon around the aircraft.

Nozzle

The wet-wing defueling operation requires one nozzle. Use the D-1 (center point) refueling nozzle.

WARNING

Remove the dust cover and inspect the nozzle nose area for obvious damage and cleanliness before each use. Visually inspect the nozzle-locking mechanism before each fueling operation to determine that the mechanism is complete and is functioning properly. No lubrication is required between overhauls.

Coupler

One 3-inch, dry-break coupler is needed. Use it to connect the D-1 nozzle to the hose.

Fire Extinguisher

At least four potassium, stored pressure, dry chemical fire extinguishers are required. These extinguishers must be rated by Underwriter's Laboratory, incorporated at 80-B:C. Place and man the fire extinguishers as follows:

- One within 50 feet on the side of the operating aircraft engines (C-130 only), (APU, or GPU.
- One within 30 feet of the side of the center point port being used.
- One at the receiving tank or semitrailer.
- One unmanned spare within 100 feet of the center point port being used.

C-5A AIRCRAFT

C-5A aircraft have an APU and two center point refueling ports on each side of the aircraft. The fuel flow rate is 600 GPM from each port. The fuel booster pumps can be operated using a GPU or the aircraft APUs. When an APU is used to power the pumps, place it on the opposite side of the aircraft from the center point port being used. Figure 18-9 shows the layout for wet-wing defueling of a C-5A aircraft.

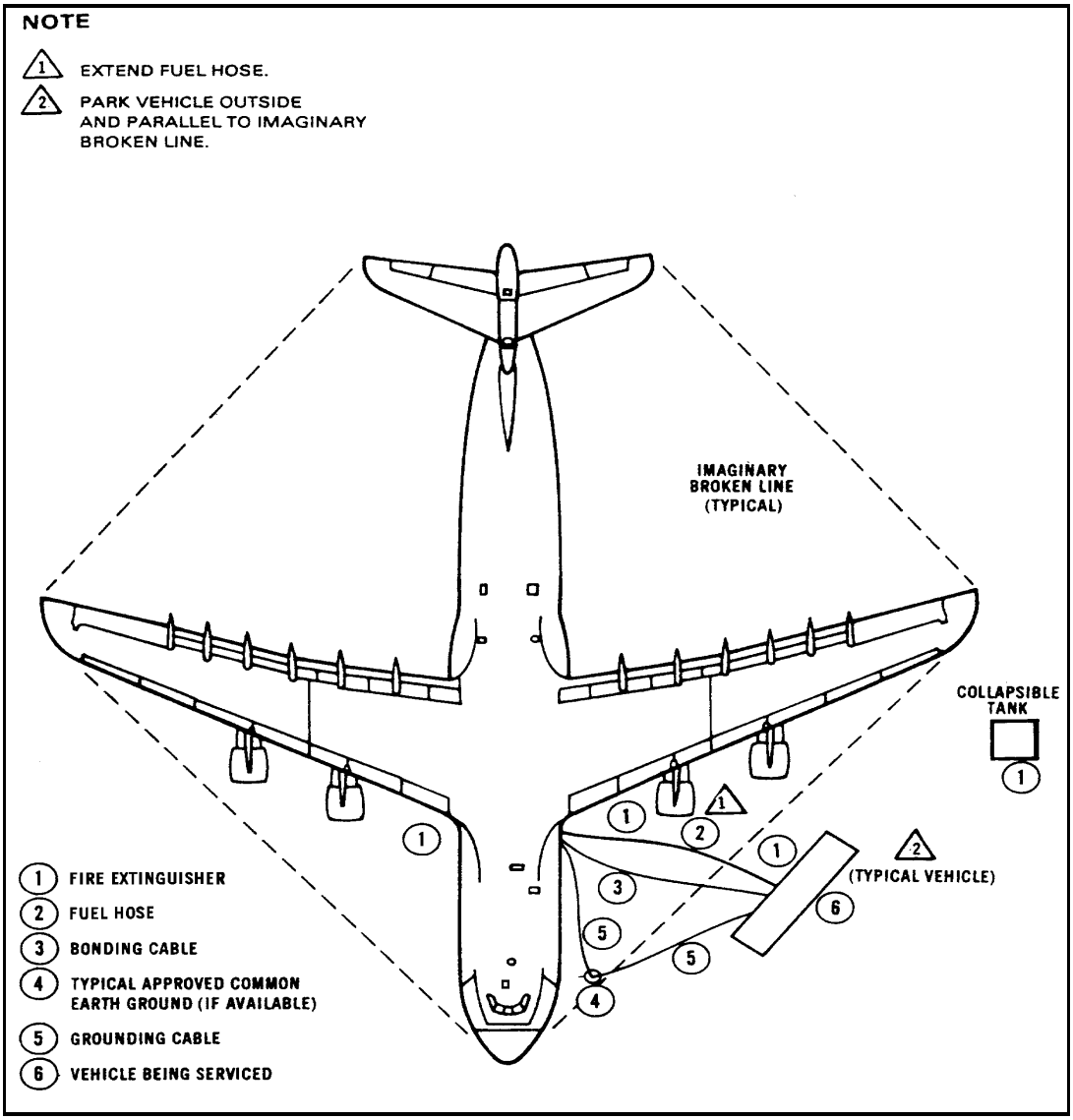

Figure 18-9. Wetwing defueling of C-5A aircraft

C-130 AIRCRAFT

The C-130 aircraft can sustain a fuel flow rate of about 400 GPM when using all 10 fuel booster pumps. Only four of the booster pumps can be used if the fuel is not carried in the external tanks. The four booster pumps produce a flow rate of about 150 GPM. The on-board booster pumps can be powered with a GPU or by number one and two engines. Both engines must be running to power the electrical buses. Do not use the APU in this operation. Figure 18-10, page 18-14**,** shows the layout for wet wing defueling of C-130 aircraft.

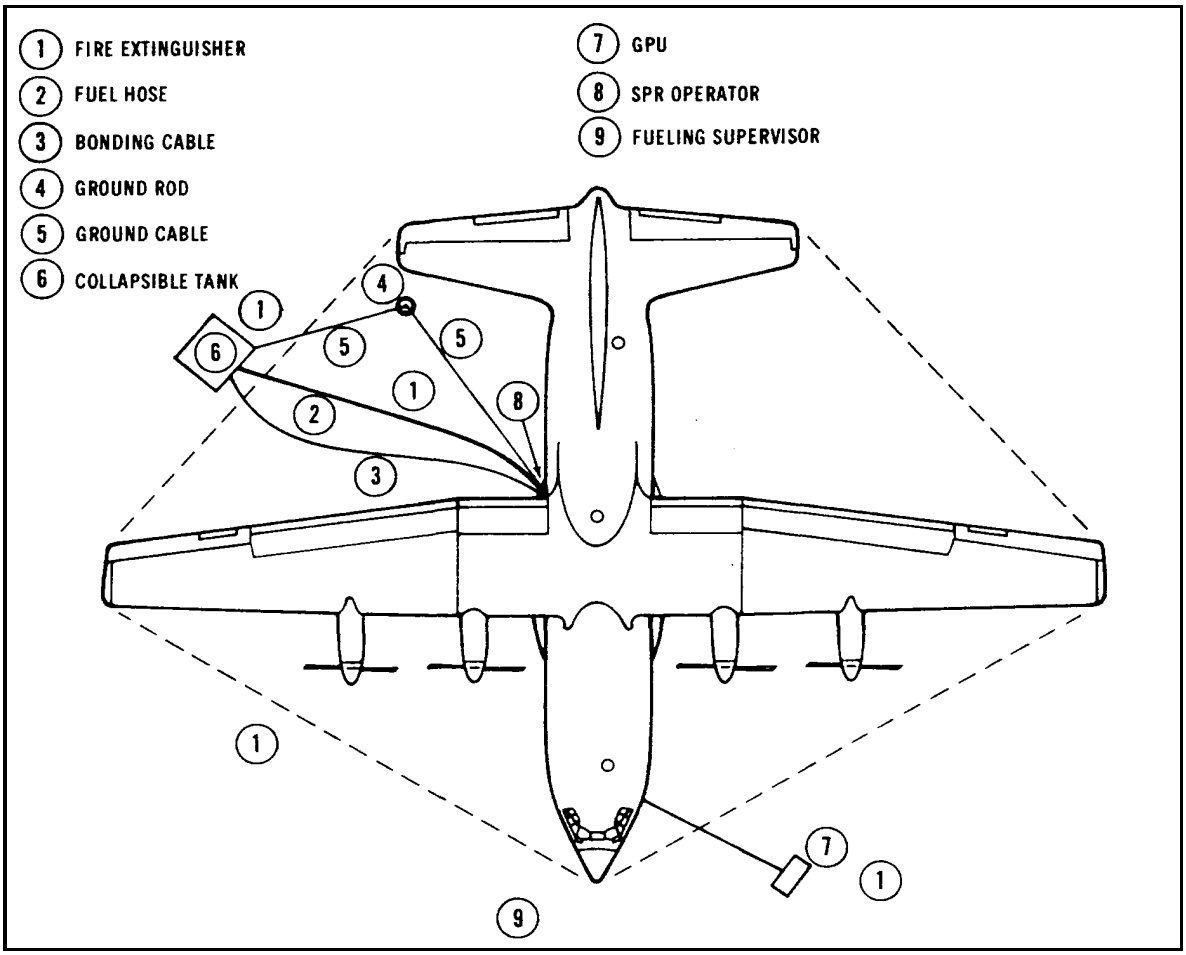

Figure 18-10. Wetwing defueling of C-130 aircraft

C-141 AIRCRAFT

The C-141 aircraft has two center point refueling ports that can be operated separately or together. The fuel flow rate is 500 GPM through one center point refueling port and 600 GPM through both center point refueling ports. The fuel booster pumps can be powered by either a GPU or the APU. Figure 18-11, page 18-15, shows the layout of wet-wing defueling of C-141 aircraft.

GROUNDING AND BONDING REQUIREMENTS

Grounding and bonding requirements for Air Force aircraft must be followed during wet-wing defueling. Use the best available ground in a fuel transfer operation. Because of the location of the operation, a proper ground cannot always be ensured. Therefore, bonding must be used to ensure equal electrostatic potentials are maintained between aircraft and the fuel receiver.

FIRE SAFETY

Sources of vapor ignition peculiar to wet-wing defueling are the operation of APUs, GPUs, and aircraft engines, particularly on the C-130. The most likely location for a fuel spill or fire during the defueling operation is at the aircraft center point refueling port during connection or disconnection. Ignition here could result from vapors reaching an APU or aircraft engine that is running or from a fuel splash or vapors reaching hot aircraft brakes. Static electricity could also be a source of ignition. Position the largest piece of fire-fighting equipment available at the aircraft center point refueling port during the operation.

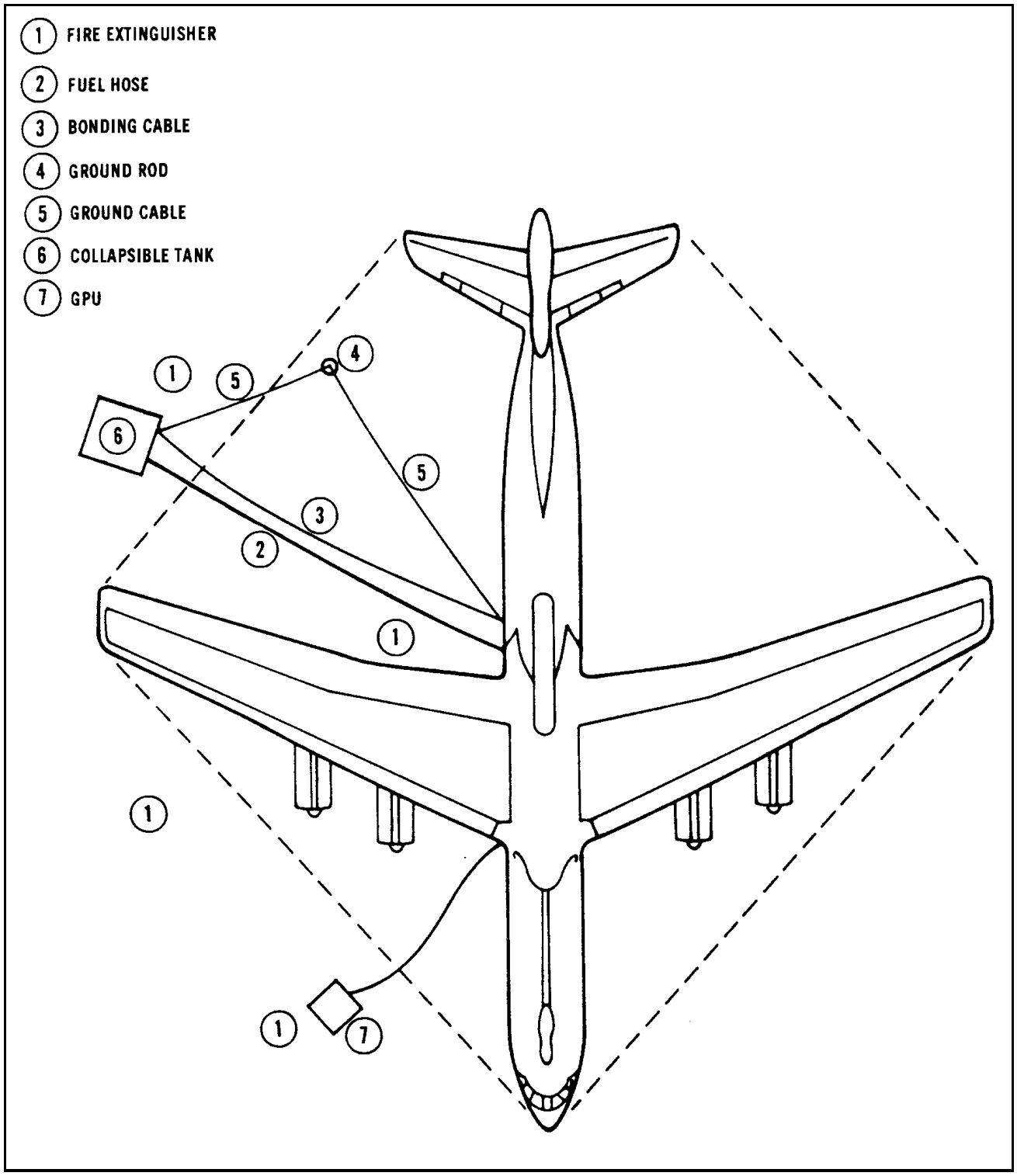

Figure 18-11. Wetwing defueling of C-141 aircraft